Space Weather Technical Forecast

Issued on Monday, 24 October 2022 at 13:21 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Geomagnetic Storms days 1 and 2 (24th and 25th). Slight chance of R1 Radio blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been Low, with several C-class flares from AR3130 in the southeast quadrant, and AR3126 in the southwest. Two further regions are weak and are considered to present a negligible risk. No earth directed CME's have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, has remained between 480-580km/s through the period due to the fast wind of coronal hole 34. Density was slightly above average between 23/130-24/0030 UTC, reaching a maximum of 18ppcc at 23/1750UTC. Total magnetic field strength was moderate until 24/0100 UTC, after which it became weak. The north-south component followed a similar trend, fluctuating between +10/-8nT but easing with time. Phi angle was negative (towards the Sun). Geomagnetic activity was generally Quiet to Unsettled (Kp 2-3) with a spell at Active between 23/1500-2400UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at normal background levels. The associated 24-hour integrated fluence was well below the Active (1e8 integrated pfu) threshold, with 1.26e6 integrated pfu observed at 24/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low or Very Low, with a slight chance of becoming Moderate with any isolated M-class flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs have been observed. The high speed stream from coronal hole 34 is expected to continue at around 500-600km/s through 24 October and perhaps 25 October. A decline in speeds is then forecast from later on 25 October through the remainder of the period. Geomagnetic activity is expected to be mainly Unsettled to Active on 24 October, with a chance of G1/Minor Storms. There is further risk of G1/Minor Storms on 25 October, resulting in a rapidly decreasing risk from later on 25 October, with activity becoming mainly Quiet to Unsettled.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at background. High energy electron flux (greater than 2MeV) is expected to be mainly background to moderate levels, increasingly reaching high (1e3pfu) levels by the end of the period. Electron fluence values are forecast to remain below the Active threshold on 24 and 25 October, but are likely to exceed the threshold on 26 and 27 October.

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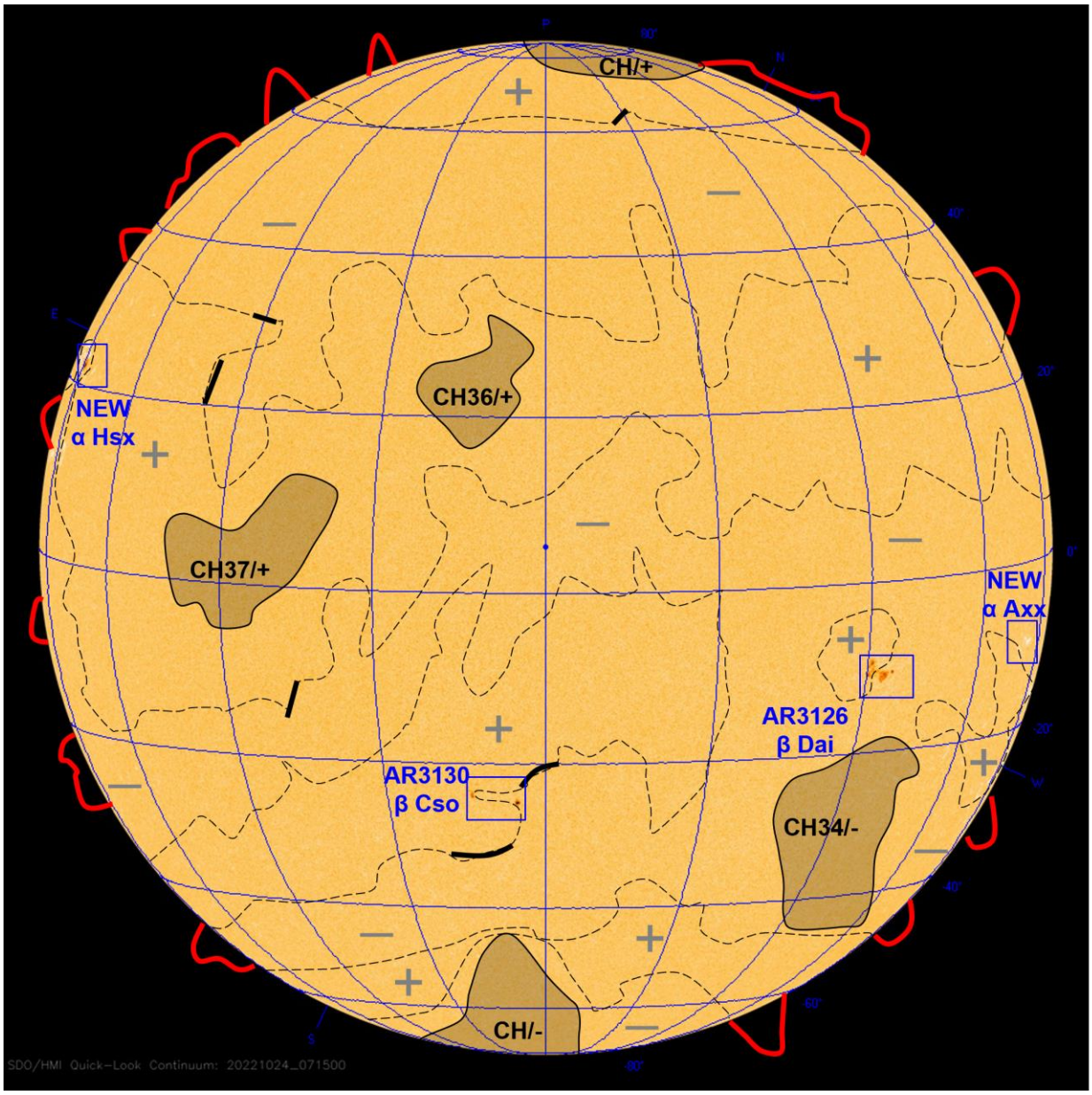
Figure 1. Solar Analysis Valid 24/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

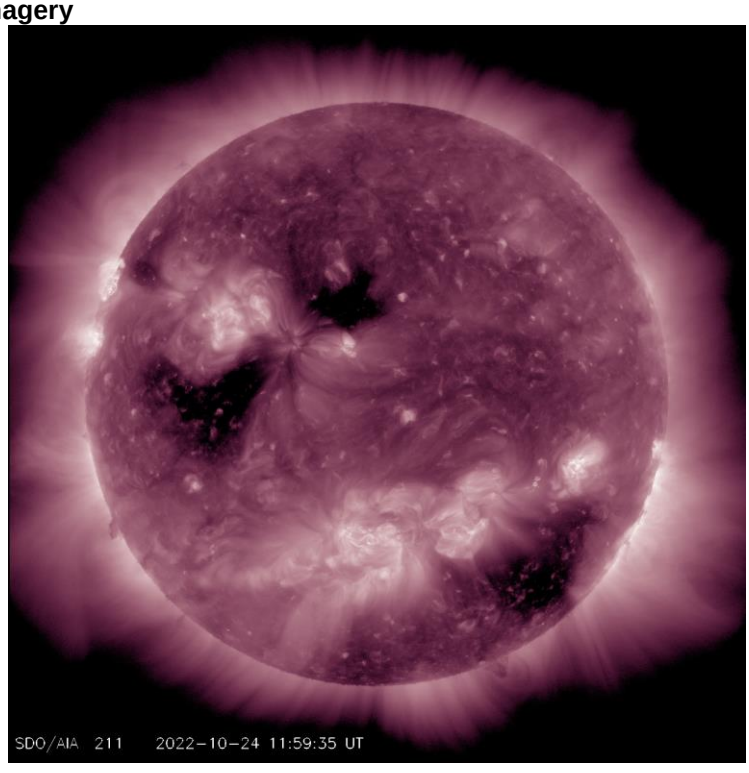
No Earth-directed CMEs are currently forecast.

The Earth is currently under the influence of a high speed stream from coronal hole 34.and is producing steady speeds of between 500-600km/s. Observations of the solar wind from STEREO A, which is just over one day ahead in Earth's orbit are suggesting a possible increase to 650-700km/s on 25 October, but given a recent slight dip in values, this is considered low confidence. A gradual return to ambient values are then possible during 26 and 27 October.

Geomagnetic activity is forecast to be mainly Unsettled to Active, with a chance of G1/Minor Storms through 24 October due to elevated solar wind speeds and a moderate interplanetary magnetic field strength. A further chance of G1/Minor Storms on 25 October, but with declining activity to mainly Quiet to Unsettled, as speeds are expected to decline. Generally Quiet to Unsettled values are then forecast for 26 and 27 October.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	10	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: 211 SDO imagery



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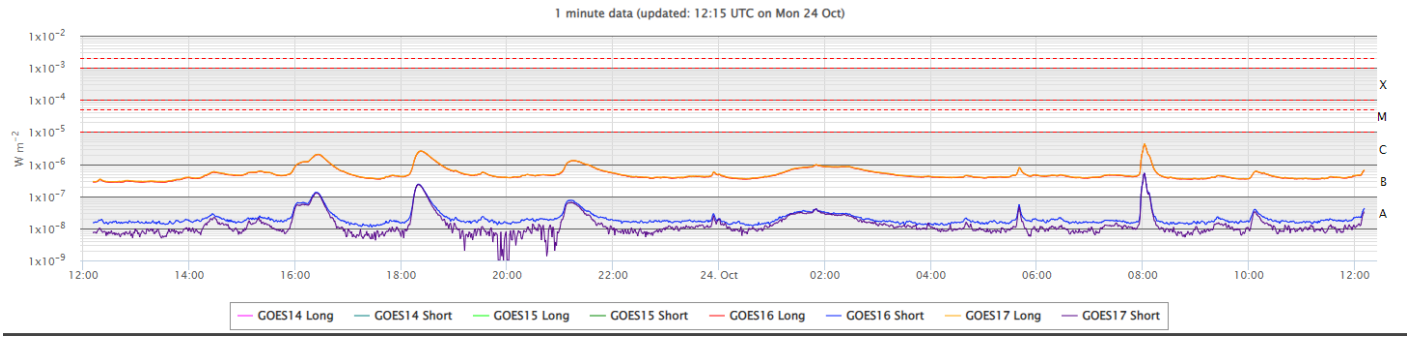
Radio Blackouts - X-Ray Flares:

Solar activity is Low, with four sunspots on the visible disc. The majority of the activity has been from evolving region AR3130 (Cro/Beta) in the southeast quadrant. The other significant region on the visible disc AR3126 (Dsi/Beta) in the southwest quadrant which is also evolving. Both have given C class flares in the past 24 hours. There continues to be a risk from flare activity from both these regions.

A number of far-sided regions are close to the eastern limb and are expected to rotate onto the visible disc later in the period, with a corresponding slight increase in M-class flare activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	25	25
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: 24 hour X-Ray trace.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at background and expected to stay at this level with no significant active regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) fell sharply from high to background levels over the last 48 hours, likely due to the compression of the radiation belts out of their natural orbits in the presence of an elevated high speed stream. This high speed stream is expected to input further particles into the belts, which should then relax into their natural orbits from later on 25 through to 27 October as the high speed stream from coronal hole 34 wanes. Electron flux is expected to increasingly reach High (1e3pfu) levels by the end of the period.

Electron fluence values are expected to remain below the Active (1e8 integrated pfu) on 24 October and for much of 25 October. The fluence is then expected to increase rapidly in line with a sharp increase in the flux from later on 25 October, with a chance of the Active threshold being reached.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	20	40	50
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	2	5	5

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